

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Appl. No. : **10/802,974**

Confirmation No. : **5079**

Applicant(s): **Sridhar Gopalakrishnan et al**

Examiner : **John C. Douglas**

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Docket No.: **1856-38100 (9852)**

Customer No.: **31889**

For: **Hydroprocessing Methods and Apparatus for Use in the Preparation Of  
Liquid Hydrocarbons**

**RESPONSE TO NOTIFICATION OF NON-COMPLIANT APPEAL BRIEF;  
SUBMISSION OF REVISED APPEAL BRIEF UNDER 37 C.F.R. § 41.37(d)**

Mail Stop Appeal Brief – Patents

Date: **October 19, 2007**

Commissioner for Patents

P. O. Box 1450

Alexandria, VA 22313-1450

Sir:

On September 5, 2007, an Appeal Brief was submitted for the above-referenced patent application. On September 26, 2007, the Patent Office issued a Notification of Non-Compliant Appeal Brief based on the omission of a mapped Claim 28 in Section V. By this Response Appellant also presents a Revised Appeal Brief which now includes a mapped Claim 28. It is believed that this presentation of the Appeal Brief is complete and ready for consideration by the Board of Appeals.

This is an appeal from the *Final Office Action* dated March 8, 2007 and it is noted that a charge against the Assignee's Deposit Account for the \$500 fee required under 37 C.F.R. §41.20(b)(2) was made on September 6, 2007. Applicants' *Notice of Appeal* was filed on June 5, 2007. The two month time period for filing this *Appeal Brief* was set to expire on August 5, 2007. Appellants requested a one-month extension of time to file the Appeal Brief and submitted a Petition for Extension of Time (PTO/SB/22) and the corresponding fee payment (\$120) to extend the time period to September 5, 2007 was also charged against the above deposit account on September 6, 2007. Should any other fees have been inadvertently omitted,

or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to **Deposit Account Number 16-1575**, and if necessary, please consider this submission as a petition for an additional extension of time and charge any necessary fees that may be due for this extension to the Deposit Account listed above.

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**I. REAL PARTY OF INTEREST**

The real party of interest of the above-identified patent application is **ConocoPhillips Company** by virtue of an assignment from the five inventors recorded in the U.S. Patent and Trademark Office on July 26, 2004 at **Reel No. 015601, Frame No. 0834**. ConocoPhillips Company is a corporation organized and existing under the laws of State of Delaware in the United States of America, and having its main office at 600 North Dairy Ashford, Houston, Texas 77079.

**II. RELATED APPEALS AND INTERFERENCES**

There are no appeals, interferences, or judicial proceeding known to Appellants, the Appellants' legal representative, or Assignee, which may be related to, directly affect, be directly affected by, or have a bearing on the decision of the Board of Patent Appeals and Interferences in this pending appeal.

**III. STATUS OF CLAIMS**

Claims 1-8 and 10-42 are pending and are listed in the CLAIMS APPENDIX (VIII).

Claims 8 and 13 are allowed.

Claims 1-7, 10-12 and 14-42 stand rejected and are the subject of this appeal.

**IV. STATUS OF AMENDMENTS**

Appellants have submitted only one Amendment and that Amendment followed the first Office Action. As such the single Amendment filed by Appellants has been entered and there are no un-entered Amendments.

**V. SUMMARY OF CLAIMED SUBJECT MATTER**

The claimed subject matter relates to methods for producing a diesel product having enhanced properties by increasing the degree of isomerization therein.

Independent Claim 1 sets forth a method wherein step (a) is reacting a mixture of hydrogen and carbon monoxide at conversion promoting conditions to form a synthetic

hydrocarbon stream, wherein the synthetic hydrocarbon stream comprises primarily C5+ paraffins (page 11, ¶0039, lines 2-5; page 39, ¶00124, lines 1-7). Step (b) is hydrotreating the synthetic hydrocarbon stream under mild hydrotreating conditions (page 11, ¶0040, lines 13-15; page 18, ¶0063, lines 1-5) and step (c) is forming a fractionator feedstream comprising the hydrotreated synthetic hydrocarbon stream (page 21, ¶0066, lines 1-3; page 21, ¶0067, lines 1-2). Step (d) is separating the fractionator feedstream into at least three fractions including: (i) a light fraction, (ii) an intermediate fraction, and (iii) a heavy fraction (page 11-12, ¶0041, lines 1-6 and Drawing Figures 1-5, elements 25, 30 and 35). The light fraction has a boiling range with a 5% boiling point of about 300°F (page 4, ¶0015, line 7). The intermediate fraction has a boiling range with a 5% boiling point lower than that of the heavy fraction, and higher than that of the light fraction (page 4, ¶0015, line 8-9). Step (e) is passing at least a portion of the heavy fraction to a first hydroconversion zone containing a hydrocracking catalyst (page 13, ¶0044, line 1). Step (f) is reacting at least a portion of the heavy fraction from step (d) with hydrogen under hydrocracking promoting conditions in the first hydroconversion zone to form a first hydroconverted effluent (page 13, ¶0044, lines 1-4). Step (g) is passing at least a portion of the first hydroconverted effluent to a second hydroconversion zone (page 13, ¶0044, lines 4-5). Step (h) is passing at least a portion of the intermediate fraction to the second hydroconversion zone (page 13, ¶0039, lines 1-2). Step (i) is reacting at least a portion of the first hydroconverted effluent and at least a portion of the intermediate fraction with hydrogen in the second hydroconversion zone with a catalyst under conditions suitable to promote hydroisomerization, hydrocracking, dewaxing, or combinations thereof, to form a second hydroconverted effluent, wherein the portion of the intermediate fraction passed to the second hydroconversion zone and the portion of the first hydroconverted effluent passed to the second hydroconversion zone have lost their separate identities (page 13, ¶0045, lines 1-10).

Dependent Claim 22 adds to the method of Claim 21 that the intermediate fraction comprises a boiling range with a 5% boiling point  $T_1$  and a 95% boiling point  $T_J$ , wherein  $T_J$  is between about  $T_H - 100^\circ\text{F}$  and  $T_H + 150^\circ\text{F}$ , and wherein  $T_1$  is between about  $500^\circ\text{F}$  and  $T_J - 50^\circ\text{F}$  (page 23, ¶0072, lines 5-7).

Dependent Claim 23 adds to the method of Claim 21 that the light fraction comprises a boiling range with a 5% boiling point between about  $330^\circ\text{F}$  and about  $350^\circ\text{F}$  and a 95% boiling

point  $T_k$ , wherein  $T_k$  is between about  $T_1 - 50^\circ\text{F}$  and  $T_1 + 50^\circ\text{F}$ , if  $T_1$  is less than  $640^\circ\text{F}$ , or  $T_k$  is about equal to about  $640^\circ\text{F}$  if  $T_1$  is greater than about  $640^\circ\text{F}$  (page 23, ¶0072, lines 8-11).

Dependent Claim 25 adds to the method of Claim 24 wherein the intermediate fraction comprises hydrocarbons having between about 15 and about 20 carbon atoms (page 22, ¶0069, lines 18-20).

Independent Claim 28 sets forth a method for increasing the degree of isomerization of a diesel product derived from synthesis gas (page 11, ¶0039, lines 2-5; page 39, ¶00124, lines 1-7). The method comprises providing a hydrocarbon stream comprising  $C_{5+}$  paraffins, wherein a majority of said  $C_{5+}$  paraffins are products of a hydrocarbon synthesis from synthesis gas and wherein the products from the hydrocarbon synthesis have been first subjected to hydrotreating under mild hydrotreating conditions (page 18, ¶0063, line 1). Step (a) is providing a first fraction comprising  $C_{20+}$  liquid hydrocarbons, wherein said first fraction has a 5% boiling point equal to or greater than about  $640^\circ\text{F}$  (page 23, ¶0071, line 7 and page 23, ¶0072, lines 1-4). Step (b) is providing a second fraction comprising  $C_{15}-C_{20}$  liquid hydrocarbons wherein said second fraction has a 5% boiling point between about  $400^\circ\text{F}$  and about  $550^\circ\text{F}$ , and a 95% boiling point equal to or less than about  $640^\circ\text{F}$  (page 12, ¶0042, lines 1-2; page 23, ¶0071, line 6 and page 23, ¶0072, lines 8-11). Step (d) is wherein the first and second fractions comprise primarily paraffins synthesized from synthesis gas (page 11, ¶0039, lines 1-5 and page 11, ¶0040, lines 1-6). Step (e) is reacting at least a portion of the first fraction in a first hydroconversion zone to generate a first hydroconverted hydrocarbon product stream (page 13, ¶0044, lines 1-4). Step (f) is reacting at least a portion of the second fraction in a second hydroconversion zone to generate a second hydroconverted hydrocarbon product stream (page 13, ¶0045, lines 1-2). Step (g) is wherein at least a portion of the first hydroconverted hydrocarbon product stream is optionally fed to the second hydroconversion zone (page 13, ¶0044, lines 4-5).

Independent Claim 37 sets forth a method for increasing the production yield of a diesel product, wherein the diesel product comprises primarily products derived from a hydrocarbon synthesis (page 11, ¶0039, lines 2-5; page 39, ¶00124, lines 1-7). The method comprises: a step (a) which is providing a hydrocarbon stream comprising  $C_{5+}$  paraffins, wherein a majority of the  $C_{5+}$  paraffins are products of a hydrocarbon synthesis from synthesis gas wherein the products from the hydrocarbon synthesis have been first subjected to hydrotreating under mild

hydrotreating conditions (page 11, ¶0040, lines 1-3; page 18, ¶0063, lines 1-5). Step (b) is separating by fractionation the hydrocarbon stream into at least (i) a wax fraction comprising a boiling range with a 5% boiling point  $T_H$ , wherein  $T_H$  is equal to or greater than about 640°F; (ii) an intermediate fraction comprising a boiling range with a 5% boiling point  $T_I$  and a 95% boiling point  $T_J$ , wherein  $T_J$  is between about  $T_H-100^\circ\text{F}$  and  $T_H+150^\circ\text{F}$ , and wherein  $T_I$  is between about 500°F and  $T_J-50^\circ\text{F}$ ; and (iii) a middle distillate fraction comprising a boiling range with a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point  $T_k$ , wherein  $T_k$  is between about  $T_I-50^\circ\text{F}$  and  $T_I+50^\circ\text{F}$ , if  $T_I$  is less than about 640°F, or  $T_k$  is equal to about 640°F if  $T_I$  is greater than 640°F (page 23, ¶0072, lines 1-11). Step (c) is passing at least a portion of the wax fraction in a first hydroconversion zone under hydrocracking promoting conditions to convert with hydrogen at least a portion of the wax fraction to form a first hydroconverted effluent (page 24, ¶0072, lines 12-14). Step (d) is reacting in the presence of hydrogen the first hydroconverted effluent and at least a portion of intermediate fraction in a second hydroconversion reaction zone under suitable hydroconversion conditions to promote hydroisomerization, hydrocracking, dewaxing, or any combination thereof, to form a second hydroconverted effluent (page 24, ¶0072, lines 14-16). Step (e) is feeding said second hydroconverted effluent to the fractionator of step (b) (page 24, ¶0072, lines 16-17) and step (f) is forming a diesel product, wherein said diesel product comprises at least a portion of the resulting middle distillate fraction and optionally a portion of the intermediate fraction if  $T_J$  is less than about 640°F (page 24, ¶0072, lines 17-19).

## **VI. GROUNDS OF REJECTIONS TO BE REVIEWED ON APPEAL**

Appellants appeal the rejections on the following grounds:

- A. Whether Claims 1-7, 10-12, 14-21, 24, 26-36 are unpatentable as being obvious under 35 U.S.C. 103 (a) over *Moore* (US Patent No. 6,583,186) in view of *Davis* (US Patent No. 5,378,348) and *Hamner* (US Patent No. 4,943,672).
- B. Whether Claims 22, 23 and 25 are unpatentable as being obvious under 35 U.S.C. 103 (a) over *Moore* in view of *Davis* and *Hamner* and further in view of *Tomlinson* (WO 01/59034).

- C. Whether Claims 37-42 are unpatentable as being obvious under 35 U.S.C. 103 (a) over *Moore* in view of *Wittenbrink* (US Patent No. 5,888,376).

## **VII. ARGUMENTS**

### **A. Grouping of Claims**

For the purpose of this Appeal, Appellants request the Examiners-in-Chief to review the claims in the following groupings:

Group I: Claims 1-7, 10-12, 14-21, 24, 26-36.

Group II: Claims 22, 23 and 25

Group III: Claims 37-42.

### **B. Cited References**

*Moore* (US Patent No. 6,583,186) discloses a method for upgrading a Fischer-Tropsch (hereinafter 'FT') wax using split-feed hydrocracking/hydrotreating. Wax products from a FT reactor are separated in a fractionator into a heavy fraction which is sent to a hydrocracking reactor. A light fraction is combined with the heavy fraction after the heavy fraction emerges from the last hydrocracking bed and the combined stream is subjected to hydrotreatment.

*Davis* (US Patent No. 5,378,348) discloses distillate fuel production from FT wax where the FT wax feed is separated into at least two fractions and the lighter fraction is subjected to a hydrotreatment and hydroisomerization while the heavier fraction is hydroisomerized without intermediate hydrotreatment.

*Hamner* (US Patent No. 4,943,672) discloses a process for the hydroisomerization of high melting temperature FT wax to produce lubricating oil having high viscosity and low pour point temperature. High melting temperature FT wax is introduced into a hydrotreater under severe hydrotreating conditions to begin the process of accomplishing considerable structural modification. The hydrotreating serves a dual purpose, namely, removal of the impurities and conversion of some of the FT wax.

*Tomlinson* (WO 01/59034) discloses fuel made from a FT synthesis wherein the products from the FT synthesis are separated by fractionation, the middle and heavy fractions being subject to hydrocracking and the resulting hydrocrackates subject to further fractionation to yield the desired fuel or additive products.

*Wittenbrink* (US Patent No. 5,888,376) discloses a process for converting a FT light oil stream to jet fuel by reacting the stream with a hydroisomerization catalyst in a reaction zone where the stream flows countercurrent to the hydrogen treat gas.

**C. Rejections under 35 U.S.C. 103(a) of Claims 1-7, 10-12, 14-21, 24, 26-36 over *Moore* in view of *Davis* and *Hamner***

In the rejected Claims 1-7, 10-12, 14-21, 24, 26-36 (group I), Appellants have set forth a process which includes many steps. Among the steps is step (b) which calls for the synthetic hydrocarbon stream to be hydrotreated under mild hydrotreating conditions. This is the hydrocarbon stream created in step (a) that comprises primarily C<sub>5</sub>+ paraffins. It is after this mild hydrotreatment that the stream is fractionated into separate fractions, and additional subsequent processing steps are described to produce an isomerized diesel product. Appellants are not arguing that mild hydrotreatment in and of itself renders the claimed invention patentable. Appellants' claims are far more detailed and specific. At a first cursory level of review, the prior art references do not describe mild hydrotreatment of the FT hydrocarbon stream prior to a fractionation step and then followed by two fractions being subjected to hydroconversion steps (hydrocracking and/or hydroisomerization). Without these basic series of steps being shown by the prior art, it seems pretty straight forward that the claims are clearly distinguished over the prior art without getting to a more detailed consideration of the Appellants' claims. The point is that it should be emphasized that the steps of Appellants' claimed invention of Group I are also set forth in a specific order which the cited references do not teach nor suggest. The order of such steps are not mere design choices that are otherwise insignificant. As will be discussed further below, the references at least suggest that order matters. Those having ordinary skill in the art should recognize that the order of these kinds of steps on these kinds of products has bearing on the products themselves and on the performance of the process.

To review *Moore* briefly, *Moore* discloses fractionation first, hydrocracking one fraction and does not disclose hydrotreatment until after hydrocracking of the one fraction and after the streams are combined again. To the extent that one might argue that *Moore* shows a stream passing through the hydrotreatment bed 45, entering a fractionation tower where a light fraction 55 is produced only one fraction is shown to be directed to a hydrocracker (hydrocracker 25).



The fraction 55 is not directed to any further hydroconversion bed presumably because it is a finished product.

To provide a similarly brief consideration of *Davis*, *Davis* discloses fractionation of FT products first and then hydroisomerizing the heavier fraction expressly without hydrotreating. *Davis* does disclose hydrotreating of the lighter fraction, but of the lighter fraction only and then hydroisomerizing the hydrotreated light product. An important point to note about *Davis* is that the reason the heavier fraction is not hydrotreated prior to hydroisomerizing is to improve the cold flow properties of the product. This point is echoed in *Moore* at Column 9, lines 23-25 where it is noted that good isomerization is good for pour point properties.

Immediately prior to turning to *Hamner*, it is noted that to the extent that the above comments were not persuasive as to *Moore* and *Davis*, it appears to Appellants that the Examiner is in agreement that the combination of *Moore* with *Davis* does not lead an artisan having ordinary skill to provide a mild hydrotreatment for a range synthetic hydrocarbon stream, then fractionating the hydrotreated synthetic hydrocarbon stream and then subjecting two resulting fractions to hydroconversion. Indeed, the Examiner has introduced *Hamner* to the combination of *Moore* and *Davis* to provide a teaching of mild hydrotreatment.

Appellants must also point out that *Hamner* is directed to the production of lubricating oil and not to the production of diesel or middle distillate fuel. Those skilled in the art know that these products are quite different. For example, *Hamner* describes his product as having a boiling range of from about 700 °F to about 1050 °F. *Hamner* describes his starting material in his Example as being a 700 °F+ fraction of a total Fischer-Tropsch synthesis product. On the other hand, diesels and other middle distillate fuels generally have upper end boiling ranges near or below the low end of the boiling ranges of lubricant oils. Thus, a hydrocarbon stream having an initial boiling temperature of less than 700 °F might make a diesel product, but is not really a suitable starting material for lubricants because the boiling range is too low. Persons having ordinary skill in the art will naturally select starting materials for lubricants that have boiling temperatures of at least 700 °F because it is far easier and cheaper to make higher boiling temperature hydrocarbon materials into lower boiling temperature hydrocarbon materials than it is to make lower boiling temperature materials into higher temperature boiling hydrocarbon materials.

In order to obtain a 700 °F+ fraction of a total Fischer-Tropsch synthesis product, it is inferred from *Hamner* that the total FT synthesis product is first subjected to fractionation even though such first step fractionation is not shown in the drawings. However, it is recognized that fractionation is shown at vessel F-1 where the light fraction having a boiling temp below 640 °F is ejected at the top, the middle fractionation is subjected to a dewaxing process and the heavier fraction is recycled back for more hydrotreating. This second fractionation will be the primary focus of *Hamner* since it is closer on point to the present invention.

*Hamner* discloses hydrotreating prior to fractionation, but contrary to what is stated in the Final Office Action, *Hamner* does not teach mild hydrotreating in this context. As related to FT products, *Hamner* specifically indicates a preference for severe hydrotreating. As compared to the mild hydrotreating, *Hamner* is intending to soften the FT wax and the ‘severe hydrotreatment’ step in *Hamner* further includes isomerization and hydrocracking of the wax during this step, as it is recapped in step (a) of *Hamner*’s claim 1. See *Hamner* Col 9 lines 39-44. Appellants’ mild hydrotreating is deliberately not for converting any paraffins. It is noted that the Examiner has stated that *Hamner* discloses hydrotreating the Fischer-Tropsch product under mild conditions removes impurities without conversion of the higher-boiling Fischer-Tropsch wax. (see Final Rejection, Page 4, lines 13-15). It is true that *Hamner* recites those words, but the sentence from which the Examiner finds this statement concludes “but more severe hydrotreating conditions are preferred in the process of the present invention in order to convert some of the higher boiling Fischer-Tropsch wax.” (Column 3, line 67 to column 4, line 4) Appellant must emphasize the words “convert” and “severe” and “preferred”. Conversion is a different process than hydrotreatment as set forth as a definition in the instant specification at page 7-8, ¶ 0024, lines 1-9 and a person having ordinary skill in the art would recognize that severe hydrotreating as described by *Hamner* is different than the mild hydrotreatment of the present invention.

*Hamner* does provide a further discussion of mild hydrotreating, but does it in the context of petroleum slack wax. Petroleum slack wax is not an FT wax or a synthetically derived material but is derived from crude oil (hence the descriptor ‘petroleum’). Mild hydrotreating of petroleum slack wax aids in lubricating oil production by removing nitrogen and sulfur, while avoiding conversion of the naphthenes and isoparaffins already present in petroleum slack wax.

Thus, unlike petroleum slack wax, the production of lubricating oil from high-melting Fischer-Tropsch wax (which comprises 99%<sup>+</sup> of normal paraffins – see *Hamner* Col. 3 lines 59-60) according to *Hamner* requires considerable structural modification (e.g. conversion of n-paraffins to isoparaffins), particularly for the wax fraction boiling above 1050°F. See *Hamner* Col. 3 lines 54-67. Thus, *Hamner* has found advantageous to employ relatively severe hydrotreating conditions in order to not only remove nitrogen and sulfur but also to ‘soften’ the FT wax (i.e., at least partially hydrocrack and isomerize the wax). See *Hamner* Col. 4 lines 11-15; Col 9 lines 42-44. These relatively severe hydrotreating conditions employ a temperature range from *ca.* 650°F and *ca.* 775°F. See *Hamner* Col. 4 lines 15-32. This is a higher temperature range than the temperature range of from 350°F to about 600°F (about 170-315°C) disclosed by Appellants for mild hydrotreatment in ¶ 0063 on pages 18-19 of the specification as filed.

Thus, a person having ordinary skill in the art and wishing to make an improved isomerized diesel product, but without the benefit of Appellants’ disclosure, that is presented with these three references, a first reference that does not hydrotreat the hydrocarbon prior to fractionation but includes some hydrocracking and hydroprocessing of at least two of the fractionated streams (*Moore*), a second reference that strongly recommends NOT hydrotreating the 500°F<sup>+</sup> FT fraction before this fraction is subjected to hydroisomerization for very compelling reasons (*Davis*) and a third reference that relates to the production of a very different hydrocarbon product and that discloses a severe hydrotreatment of heavy FT wax where ‘severe’ means conversion of paraffins (*Hamner*) is not likely to be persuaded to hydrotreat a broad range FT product prior to fractionation and subsequent hydroconversion steps, since none of these three references teaches or suggests hydrotreating a broad range FT product prior to fractionation. Second, that person appears unlikely to use the teaching of *Hamner* which is antithetical to *Davis*’ teaching with respect to avoiding hydrotreatment of the 500<sup>+</sup> fraction, since *Davis* is more on point with the generation of the desired product of improved cold-flow properties. Moreover, to the extent that *Hamner* provides some guidance on hydrotreating prior to hydroconversion, it is bad guidance from the standpoint of arriving at Appellant’s invention since the cold flow properties that are desired by the diesel/jet fuel market place and are clearly identified in *Davis* are obtained by *Hamner* by an order of steps (hydrotreating before

hydroconversion) which is deemed improper per *Davis*'s teaching in achieving these desired cold flow properties. Moreover, the hydrotreating in *Hamner* is far from being the mild hydrotreating of Appellants' claimed invention, not only in terms of temperature conditions but also in terms of coexisting partial hydroconversion to smaller and/or isomerized hydrocarbons.

To avoid any suggestion or conclusion that Appellants' process arrangements are merely a matter of obvious design choice, there are benefits of mild hydrotreating disclosed in the present application. For example, now that Appellants have developed the process arrangement disclosed and claimed in this application, certain advantages can be understood. Appellants have recognized that mild hydrotreating utilizes less expensive catalysts and, in addition to performing its primary functions of removing heteroatomic compounds and saturating olefins, solids that may be contaminants for hydrocracking are likely to be trapped in the hydrotreating reactor and protect that more expensive catalysts used in hydrocracking systems. Although the cited art does not show mild hydrotreating prior to fractionation, it can be recognized that olefins and heteroatomic compounds that are present in the range of fractions and are quite easily addressed in a first mild hydrotreatment step prior to separation into separate fractions. A single vessel is used for the broad range of the synthetic hydrocarbon stream.

Turning back to *Davis*, *Davis* actually teaches away from the claimed invention. *Davis* explains that it is important not to hydrotreat the 500°F<sup>+</sup> fraction prior to hydroisomerization, as such hydrotreatment is detrimental to the cold flow properties of the product. See *Davis* Col. 2 lines 51-66 (especially lines 57-66). Cold flow properties of distillate fuels are very important to their marketability, especially in winter climates. The reason for isomerization of distillate fuels is to improve cold flow properties; thus anything that would negatively impact the accomplishment of good cold flow properties in the desired product would be a considerable disincentive for those having ordinary skill in the art. Thus, an artisan reading *Davis* and wishing to increase the degree of isomerization of diesel produced from FT hydrocarbons is taught by *Davis* to avoid hydrotreating a 500°F<sup>+</sup> fraction prior to isomerizing and therefore is led away from Appellants' claimed invention.

Moreover, *Davis* clearly teaches that the order of steps matter and should not be discounted as being unimportant. The steps simply cannot be arranged in any random order and with the expectation that all permutations are equal and obvious. The order of the steps alter the

compositions and/or physical properties of feeds to these steps and effluents from these steps, and thus the chemistry and/or conditions in each step can be, and generally will be, modified. *Davis* most assuredly indicates that this is true by indicating a plan to avoid hydrotreating prior to hydroisomerizing.

In addition, it should be recognized that the brunt of the sulfur-containing and nitrogen-containing compounds present in the heavy fraction in *Moore* and *Davis* is taken by the hydrocracking catalyst in the process of *Moore* and *Davis*. Thus, this hydrocracking step suggests that the hydrocracking catalyst is not sulfur sensitive. See for example *Moore* Col. 9 lines 28-30. In fact, a first hydroconversion step which is exposed to a sulfur-containing hydrocarbon stream generally contains a catalyst which has enhanced performance when in the presence of sulfur, such as a sulfided hydroconversion catalyst. The sulfiding is described in *Moore* Col. 9 lines 36-37; Col. 10 lines 43-44. Thus, the lack of hydrotreatment (which is designed to remove these sulfur-containing and nitrogen-containing impurities) prior to a hydrocracking and/or hydroisomerization suggests that sulfur enhances performance and a person having ordinary skill in the art would have another reason not to insert a mild hydrotreatment step regardless of what the Examiner has identified in *Hamner*.

Finally, just because elements of Appellants claims may be found in various references does not render the claimed invention obvious. Appellants assert that it would not have been obvious to a person having ordinary skill in the art to combine these references in the manner proposed by the Examiner to meet the claims without Appellants disclosure. In view of all of the forgoing reasons, Appellants' invention as embodied in claims in Group I is asserted to be patentable.

**D. Rejections under 35 U.S.C. 103(a) of Claims 22, 23 and 25 over *Moore* in view of *Davis* and *Hamner* and further in view of *Tomlinson***

The arguments set forth above apply for the Claims in Group II in the same way they apply for the Claims in Group I. *Tomlinson* does not teach or provide any suggestion for hydrotreating prior to fractionation followed by hydroconversion of two streams. At best, *Tomlinson* is silent and in reality indicates that fractionation comes before hydrocracking. Appellants have not found any mention of hydrotreating in *Tomlinson*.

Not only does the combination of *Moore* with *Davis*, *Hamner* and *Tomlinson* not teach or suggest all of the elements of Claim 1 from which the Group II claims (22, 23, 25) depend, there is further no motivation for the artisan to modify *Moore*'s teachings with the other disclosures to arrive to Claims 22 and 25.

Claim 22

With respect to Claim 22, the intermediate fraction as recited in Claim 22 has a 5% boiling point of at least 500°F. Thus, this fraction represents a 500°F<sup>+</sup> fraction per *Davis*' definition. Thus in view of the teaching away from *Davis* in NOT hydrotreating the 500°F<sup>+</sup> fraction, it is unlikely that an artisan would be motivated to generate the intermediate fraction (as recited in Claim 22) whose hydrocarbons components have been subjected to mild hydrotreatment (in step b) prior to fractionation (step d) before being fed to the second hydroconversion step (step h).

Claim 23

Similarly, with respect to Claim 25, the intermediate fraction comprises hydrocarbons having about 15 and about 20 carbon atoms. Per Appellants' disclosure in ¶0069 on page 22 of the specification, this C<sub>15</sub>-C<sub>20</sub> hydrocarbons fraction has a boiling range comprising a 5% boiling point of about 570°F and a 95% boiling point of about 640°F, thus representing a 500°F<sup>+</sup> fraction per *Davis*' definition. In view of the teaching away from *Davis* in not hydrotreating the 500°F<sup>+</sup> fraction, it is unlikely that the artisan would be motivated to generate the intermediate fraction comprising hydrocarbons having about 15 and about 20 carbon atoms (as recited in Claim 22) which have been subjected to mild hydrotreatment (in step b) prior to fractionation (step d) before being fed to the second hydroconversion step (step h).

As such, the combination of *Moore* with *Davis*, *Hamner* and *Tomlinson* does not render the Group II claims unpatentable, for such combination does not offer guidance to the artisan towards the modification of *Moore*'s process with the other three references, as suggested by the Examiner.

In addition, it must be recognized that the basis for rejection of the Claims of Group II is a combination of four references. While it is conceded that there may be circumstances where four references may be combined to render a claimed invention to be obvious, it must also be recognized that a rejection by the Patent Office based on four references suggests that the

Examiner may have indulged in a little hindsight reconstruction. In this situation, Appellants assert that the combination of these four references so as to reject the claims can only be accomplished by hindsight reconstruction. Moreover, even if, *arguendo*, the rejection of the claims in Group I was 100% sustainable to the Board of Appeals or higher, the Examiner and now the Examiners-in-Chief must consider the obviousness of combining all four references as they exist in their stand alone disclosures without taking it for granted that it would have been obvious to combine three of the references. In other words, Appellants believe that combining a larger and larger number of references is inherently harder to justify as being obvious to a person having ordinary skill in the art.

In view of the foregoing arguments, Appellants submit that the combination of these four references does not provide a *prima facie* case of obviousness on Group II claims.

**E. Rejections under 35 U.S.C. 103(a) of Claims 37-42 over *Moore* in view of *Wittenbrink***

Turning now to the Claims of Group III, the issue of the hydrotreating under mild conditions prior to fractionation remains. As noted above, *Moore* does not disclose or suggest such an arrangement. *Hamner* is not cited against these claims. Only *Wittenbrink* is cited. However, *Wittenbrink* does not disclose Appellants' invention, nor the features that are at issue. *Wittenbrink* clearly identifies the feedstocks which are suitable as having a boiling range of between 40 °C and about 260 °C. When the first step is to identify a fractionation range, it should go without saying that the first step in *Wittenbrink's* process is fractionation. It is not until after the feedstock is separated into at least two fractions that any hydroisomerization or hydrotreating is accomplished.

As such, the combination of these two references does not provide each and every of the elements of the Group III claims. In view of the foregoing arguments, Appellants submit that the combination of these two references does not provide a *prima facie* case of obviousness on these claims.

## **VIII. CONCLUSION**

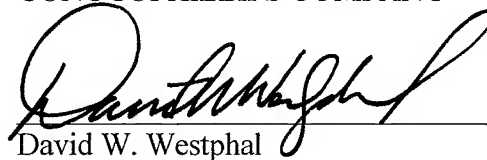
The careful review of the foregoing arguments and a full consideration of the cited art by the Examiners-in-Chief will be most appreciated as Appellants strongly believe in the

patentability of their invention. A favorable determination is anticipated and will be eagerly and heartily welcomed.

Alternatively, if the Examiner should recognize a path forward that will provide the Appellants with the scope of patentability closer to what is believed merited, or if any new or remaining issues arise, a phone call to the undersigned would be pleasantly accepted.

Respectfully submitted,

CONOCOPHILLIPS COMPANY

A handwritten signature in black ink, appearing to read "David W. Westphal", is written over a horizontal line.

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Date: October 19, 2007



## IX. CLAIMS APPENDIX

The text of the claims involved in the appeal reads as follows:

1. (Previously presented) A method for increasing the degree of isomerization of a diesel product comprising:

- (a) reacting a mixture of hydrogen and carbon monoxide at conversion promoting conditions to form a synthetic hydrocarbon stream, wherein the synthetic hydrocarbon stream comprises primarily C<sub>5+</sub> paraffins;
- (b) hydrotreating the synthetic hydrocarbon stream under mild hydrotreating conditions;
- (c) forming a fractionator feedstream comprising the hydrotreated synthetic hydrocarbon stream;
- (d) separating the fractionator feedstream into at least three fractions including:
  - (i) a light fraction;
  - (ii) an intermediate fraction; and
  - (iii) a heavy fraction;

wherein the light fraction has a boiling range with a 5% boiling point of about 300°F, wherein the intermediate fraction has a boiling range with a 5% boiling point lower than that of the heavy fraction, and higher than that of the light fraction;

- (e) passing at least a portion of the heavy fraction to a first hydroconversion zone containing a hydrocracking catalyst;

- (f) reacting at least a portion of the heavy fraction from step (d) with hydrogen under hydrocracking promoting conditions in the first hydroconversion zone to form a first hydroconverted effluent;
  - (g) passing at least a portion of the first hydroconverted effluent to a second hydroconversion zone;
  - (h) passing at least a portion of the intermediate fraction to the second hydroconversion zone; and
  - (i) reacting at least a portion of the first hydroconverted effluent and at least a portion of the intermediate fraction with hydrogen in the second hydroconversion zone with a catalyst under conditions suitable to promote hydroisomerization, hydrocracking, dewaxing, or combinations thereof, to form a second hydroconverted effluent, wherein the portion of the intermediate fraction passed to the second hydroconversion zone and the portion of the first hydroconverted effluent passed to the second hydroconversion zone have lost their separate identities.
2. (Original) The method of claim 1 further comprising
- (i) separating the second hydroconverted effluent produced in step (h) to create at least a middle distillate fraction therefrom.
3. (Original) The method of claim 2 further comprising forming a synthetic paraffinic fuel by blending
- (1) at least a portion of the light fraction from step (b);

- (2) at least a portion of the middle distillate fraction from step (i); and
  - (3) optionally, a portion of the intermediate fraction from step (b) not passed to second hydroconversion zone.
4. (Original) The method of claim 2 wherein the fractionation of steps (c) and (i) are carried out in the same fractionator.
5. (Original) The method of claim 2 wherein the fractionation of steps (c) and (i) are carried out in different fractionators.
6. (Original) The method of claim 1 wherein the hydrocarbon synthesis in step (a) comprises a Fischer-Tropsch synthesis.
7. (Original) The method of claim 1 wherein the fractionator feedstream of step (b) further comprises hydrocarbons derived from refining of a crude oil, shale oil, or tar sand source.
8. (Allowed) A method for increasing the degree of isomerization of a diesel product comprising:
- (a) reacting a mixture of hydrogen and carbon monoxide at conversion promoting conditions to form a synthetic hydrocarbon stream, wherein the synthetic hydrocarbon stream comprises primarily C<sub>5+</sub> paraffins;
  - (b) forming a fractionator feedstream comprising the synthetic hydrocarbon stream;
  - (c) separating the fractionator feedstream into at least three fractions including:

- (i) a light fraction;
- (ii) an intermediate fraction; and
- (iii) a heavy fraction;

wherein the light fraction has a boiling range with a 5% boiling point of about 300°F, wherein the intermediate fraction has a boiling range with a 5% boiling point lower than that of the heavy fraction, and higher than that of the light fraction;

- (d) passing at least a portion of the heavy fraction to a first hydroconversion zone containing a hydrocracking catalyst;
- (e) reacting at least a portion of the heavy fraction from step (d) with hydrogen under hydrocracking promoting conditions in the first hydroconversion zone to form a first hydroconverted effluent;
- (f) passing at least a portion of the first hydroconverted effluent to a second hydroconversion zone;
- (g) passing at least a portion of the intermediate fraction to the second hydroconversion zone; and
- (h) reacting at least a portion of the first hydroconverted effluent and at least a portion of the intermediate fraction with hydrogen in the second hydroconversion zone with a catalyst under conditions suitable to promote hydroisomerization, hydrocracking, dewaxing, or combinations thereof, to form a second hydroconverted effluent, wherein the portion of the intermediate fraction passed to the second hydroconversion zone and the portion of the first hydroconverted

effluent passed to the second hydroconversion zone have lost their separate identities,

wherein the synthetic hydrocarbon stream is hydrotreated under “ultra-low severity” hydrotreating conditions before forming step (b).

9. (Canceled)

10. (Original) The method of claim 1 wherein the second hydroconversion zone is located downstream of the first hydrocracking zone.

11. (Original) The method of claim 10 wherein the second hydroconversion zone comprises a dewaxing catalyst.

12. (Original) The method of claim 1 wherein the second hydroconversion zone comprises hydroisomerization promoting conditions.

13. (Allowed) A method for increasing the degree of isomerization of a diesel product comprising:

- (a) reacting a mixture of hydrogen and carbon monoxide at conversion promoting conditions to form a synthetic hydrocarbon stream, wherein the synthetic hydrocarbon stream comprises primarily C<sub>5+</sub> paraffins;
- (b) forming a fractionator feedstream comprising the synthetic hydrocarbon stream;
- (c) separating the fractionator feedstream into at least three fractions including:

- (i) a light fraction;
- (ii) an intermediate fraction; and
- (iii) a heavy fraction;

wherein the light fraction has a boiling range with a 5% boiling point of about 300°F, wherein the intermediate fraction has a boiling range with a 5% boiling point lower than that of the heavy fraction, and higher than that of the light fraction;

- (d) passing at least a portion of the heavy fraction to a first hydroconversion zone containing a hydrocracking catalyst;
- (e) reacting at least a portion of the heavy fraction from step (d) with hydrogen under hydrocracking promoting conditions in the first hydroconversion zone to form a first hydroconverted effluent;
- (f) passing at least a portion of the first hydroconverted effluent to a second hydroconversion zone;
- (g) passing at least a portion of the intermediate fraction to the second hydroconversion zone; and
- (h) reacting at least a portion of the first hydroconverted effluent and at least a portion of the intermediate fraction with hydrogen in the second hydroconversion zone with a catalyst under conditions suitable to promote hydroisomerization, hydrocracking, dewaxing, or combinations thereof, to form a second hydroconverted effluent, wherein the portion of the intermediate fraction passed to the second hydroconversion zone and the portion of the first hydroconverted

effluent passed to the second hydroconversion zone have lost their separate identities,

wherein at least one of the first and the second hydroconversion zones comprises a catalyst gradient, and further wherein the catalyst gradient has an acidity gradually decreasing along said hydroconversion zone.

14. (Original) The method of claim 1 wherein the catalysts in the first and second hydroconversion zones have the same hydrogenation component.

15. (Original) The method of claim 1 wherein the catalysts in the first and second hydroconversion zone comprise different hydrogenation components.

16. (Original) The method of claim 1 wherein the catalysts in the first and second hydroconversion zones comprise different cracking components.

17. (Original) The method of claim 1 wherein the catalyst in the second hydroconversion zone has a lower acidity than the catalyst in the first hydroconversion zone.

18. (Original) The method of claim 1 wherein the first and second hydroconversion zones are contained within a single vessel.

19. (Original) The method of claim 1 wherein the first and second hydroconversion zones are part of a continuous catalyst bed.

20. (Original) The method of claim 1 wherein the first and second hydroconversion zones are in separate vessels.
21. (Original) The method of claim 1 wherein the heavy fraction comprises a boiling range with a 5% point  $T_H$  equal to or greater than about 640°F.
22. (Original) The method of claim 21 wherein the intermediate fraction comprises a boiling range with a 5% boiling point  $T_I$  and a 95% boiling point  $T_J$ , wherein  $T_J$  is between about  $T_H - 100^\circ\text{F}$  and  $T_H + 150^\circ\text{F}$ , and wherein  $T_I$  is between about 500°F and  $T_J - 50^\circ\text{F}$ .
23. (Original) The method of claim 21 wherein the light fraction comprises a boiling range with a 5% boiling point between about 330°F and about 350°F and a 95% boiling point  $T_k$ , wherein  $T_k$  is between about  $T_I - 50^\circ\text{F}$  and  $T_I + 50^\circ\text{F}$ , if  $T_I$  is less than 640°F, or  $T_k$  is about equal to about 640°F if  $T_I$  is greater than about 640°F.
24. (Original) The method of claim 1 wherein the heavy fraction comprises hydrocarbons with 20 or more carbon atoms.
25. (Original) The method of claim 24 wherein the intermediate fraction comprises hydrocarbons having between about 15 and about 20 carbon atoms.



26. (Original) The method of claim 1 wherein the heavy fraction comprises hydrocarbons with 'n' or more carbon atoms, and the intermediate fraction comprises hydrocarbons having more than about 15 carbon atoms, but less than about 'n' carbon atoms, wherein 'n' is greater than 20.

27. (Original) The method of claim 1 wherein the second hydroconversion zone has an inlet temperature equal to or greater than that of the first hydroconverted effluent.

28. (Previously presented) A method for increasing the degree of isomerization of a diesel product, derived from synthesis gas, comprising:

providing a hydrocarbon stream comprising C<sub>5+</sub> paraffins, wherein a majority of said C<sub>5+</sub> paraffins are products of a hydrocarbon synthesis from synthesis gas wherein the products from the hydrocarbon synthesis have been first subjected to hydrotreating under mild hydrotreating conditions;

- (a) providing a first fraction comprising C<sub>20+</sub> liquid hydrocarbons, wherein said first fraction has a 5% boiling point equal to or greater than about 640°F;
- (b) providing a second fraction comprising C<sub>15</sub>-C<sub>20</sub> liquid hydrocarbons,
- (c) wherein said second fraction has a 5% boiling point between about 400°F and about 550°F, and a 95% boiling point equal to or less than about 640°F, and
- (d) wherein the first and second fractions comprise primarily paraffins synthesized from synthesis gas;
- (e) reacting at least a portion of the first fraction in a first hydroconversion zone to generate a first hydroconverted hydrocarbon product stream;

- (f) reacting at least a portion of the second fraction in a second hydroconversion zone to generate a second hydroconverted hydrocarbon product stream;
- (g) wherein at least a portion of the first hydroconverted hydrocarbon product stream is optionally fed to the second hydroconversion zone.

29. (Original) The method according to claim 28 further comprising fractionating at least a portion of the second hydroconverted hydrocarbon product stream to produce at least a middle distillate with a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point between about 500°F and about 600°F.

30. (Original) The method according to claim 29 further comprising providing a third fraction, wherein the third fraction has a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point between about 400°F and about 550°F and forming a synthetic paraffinic diesel by blending

- (1) at least a portion of the third fraction; and
- (2) at least a portion of the middle distillate.

31. (Original) The method according to claim 30 wherein the synthetic paraffinic diesel blend further comprises at least a portion of the first hydroconverted hydrocarbon product stream, wherein said fraction of the first hydroconverted hydrocarbon product has a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point between about 500°F and about 600°F.

32. (Original) The method according to claim 30 wherein the synthetic paraffinic diesel blend further comprises at least a portion of the second fraction not passed to the second hydroconversion zone.

33. (Original) The method according to claim 31 wherein the synthetic paraffinic diesel blend further comprises at least a portion of the second fraction not passed to the second hydroconversion zone.

34. (Original) The method according to claim 30 wherein the first and second fractions are hydrotreated prior to reaction in their respective hydroconversion zone.

35. (Original) The method according to claim 30 further comprising passing at least a portion of said first hydroconverted hydrocarbon product stream to the second hydroconversion zone;

36. (Original) The method of claim 35 wherein the second hydroconversion zone has an inlet temperature equal to or greater than that of the first hydroconverted hydrocarbon product stream.

37. (Previously presented) A method for increasing the production yield of a diesel product, wherein the diesel product comprises primarily products derived from a hydrocarbon synthesis, said method comprises:

- (a) providing a hydrocarbon stream comprising C<sub>5+</sub> paraffins, wherein a majority of said C<sub>5+</sub> paraffins are products of a hydrocarbon synthesis from synthesis gas

wherein the products from the hydrocarbon synthesis have been first subjected to hydrotreating under mild hydrotreating conditions;

- (b) separating by fractionation said hydrocarbon stream into at least
  - (i) a wax fraction comprising a boiling range with a 5% boiling point  $T_H$ , wherein  $T_H$  is equal to or greater than about 640°F;
  - (ii) an intermediate fraction comprising a boiling range with a 5% boiling point  $T_I$  and a 95% boiling point  $T_J$ , wherein  $T_J$  is between about  $T_H - 100^\circ\text{F}$  and  $T_H + 150^\circ\text{F}$ , and wherein  $T_I$  is between about 500°F and  $T_J - 50^\circ\text{F}$ ; and;
  - (iii) a middle distillate fraction comprising a boiling range with a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point  $T_k$ , wherein  $T_k$  is between about  $T_I - 50^\circ\text{F}$  and  $T_I + 50^\circ\text{F}$ , if  $T_I$  is less than about 640°F, or  $T_k$  is equal to about 640°F if  $T_I$  is greater than 640°F;
- (c) passing at least a portion of the wax fraction in a first hydroconversion zone under hydrocracking promoting conditions to convert with hydrogen at least a portion of the wax fraction to form a first hydroconverted effluent;
- (d) reacting in the presence of hydrogen the first hydroconverted effluent and at least a portion of intermediate fraction in a second hydroconversion reaction zone under suitable hydroconversion conditions to promote hydroisomerization, hydrocracking, dewaxing, or any combination thereof, to form a second hydroconverted effluent; and
- (e) feeding said second hydroconverted effluent to the fractionator of step (b),

- (f) forming a diesel product, wherein said diesel product comprises at least a portion of the resulting middle distillate fraction and optionally a portion of the intermediate fraction if  $T_J$  is less than about 640°F.
38. (Original) The method of claim 37 wherein  $T_H$  is about equal to about 640°F;  $T_J$  is about equal to about 640°F;  $T_I$  is between about 400°F and about 600°F; and  $T_k$  is equal to about  $T_I$ .
39. (Original) The method of claim 37 wherein  $T_H$  is about equal to about 640°F;  $T_J$  is between about 550°F and about 800°F;  $T_I$  is between about 400°F and about  $T_J-50^\circ\text{F}$ ; and  $T_k$  is equal to about  $T_I$ .
40. (Original) The method of claim 37 wherein  $T_H$  is equal to about 800°F;  $T_J$  is between about 700°F and about 850°F;  $T_I$  is between about 640°F and about  $T_J-50^\circ\text{F}$ ; and  $T_k$  is equal to about 640°F.
41. (Original) The method of claim 37 wherein  $T_H$  is about equal to about 900°F;  $T_J$  is between about 700°F and about 900°F;  $T_I$  is between about 640°F and about  $T_J-50^\circ\text{F}$ ; and  $T_k$  is equal to about 640°F.
42. (Original) The method of claim 37 further comprising passing the hydrocarbon stream in a hydrotreater under hydrotreating promoting conditions before step (b).

## **X. EVIDENCE APPENDIX**

There has been no additional evidence submitted, entered by the Examiner, or relied upon by the Appellants in the present appeal.

## **XI. RELATED PROCEEDINGS APPENDIX**

There has been no proceedings or decision rendered by a court or the Board that relate to the present application.